FAIRCHILD
SEMICONDUCTOR®

www.fairchildsemi.com

KA5x03xx-SERIES

KA5H0365R, KA5M0365R, KA5L0365R
KA5H0380R, KA5M0380R, KA5L0380R
Fairchild Power Switch(FPS)

Features

- Precision Fixed Operating Frequency (100/67/50kHz)
- Low Start-up Current(Typ. 100uA)
- Pulse by Pulse Current Limiting
- Over Current Protection
- Over Voltage Protection (Min. 25V)
- Internal Thermal Shutdown Function
- Under Voltage Lockout
- Internal High Voltage Sense FET
- Auto-Restart Mode

Applications

- SMPS for VCR, SVR, STB, DVD & DVCD
- SMPS for Printer, Facsimile & Scanner
- Adaptor for Camcorder

Description

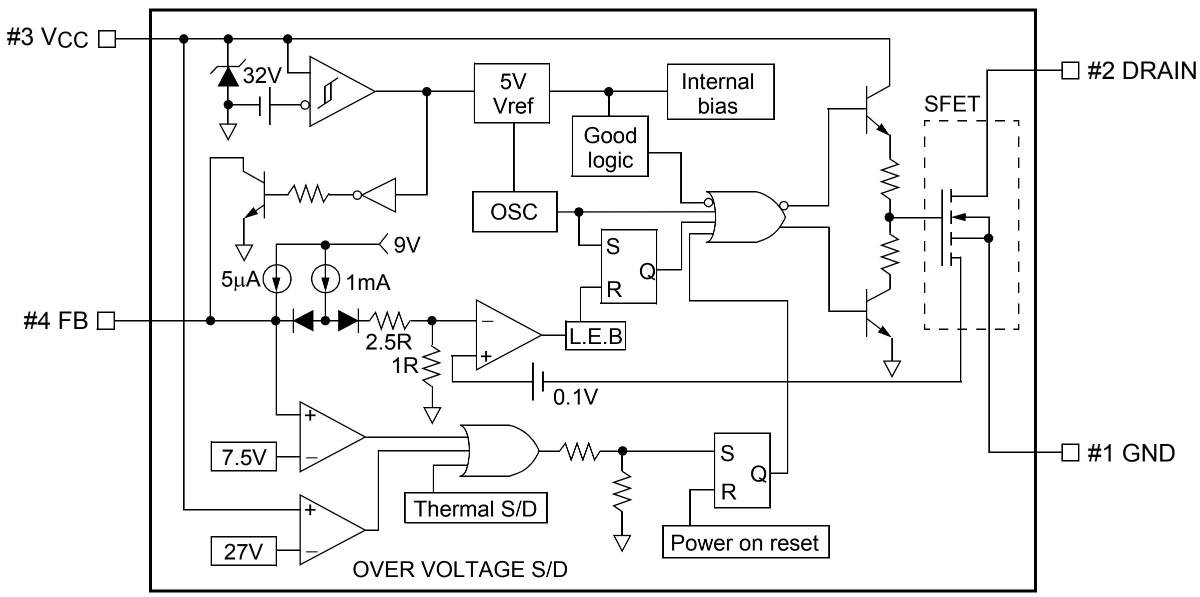
The Fairchild Power Switch(FPS) product family is specially designed for an off-line SMPS with minimal external components. The Fairchild Power Switch(FPS) consists of a high voltage power SenseFET and a current mode PWM IC. Included PWM controller integrates the fixed frequency oscillator, the under voltage lock-out, the leading edge blanking, the optimized gate turn-on/turn-off driver, the thermal shutdown protection, the over voltage protection, and the temperature compensated precision current sources for the loop compensation and the fault protection circuitry. Compared to a discrete MOSFET and a PWM controller or an RCCsolution, a Fairchild Power Switch(FPS) can reduce the total component count, design size and weight and at the same time increase efficiency, productivity, and system reliability. It has a basic platform well suited for the cost effective design in either a flyback converter or a forward converter

TO-220F-4L



1. GND 2. Drain 3. V_{CC} 4. FB

Internal Block Diagram



Rev.1.0.7

Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

Characteristic	Symbol	Value	Unit
KA5H0365R, KA5M0365R, KA5L0365R			
Drain-Gate Voltage (R_{GS}=1MΩ)	V_{DGR}	650	V
Gate-Source (GND) Voltage	V_{GS}	±30	V
Drain Current Pulsed (1)	I_{DM}	12.0	A_{DC}
Continuous Drain Current (T_C=25°C)	I_D	3.0	A_{DC}
Continuous Drain Current (T_C=100°C)	I_D	2.4	A_{DC}
Single Pulsed Avalanche Energy (2)	E_{AS}	358	mJ
Maximum Supply Voltage	$V_{CC,MAX}$	30	V
Analog Input Voltage Range	V_{FB}	-0.3 to V_{SD}	V
Total Power Dissipation	P_D	75	W
	Derating	0.6	W/°C
Operating Junction Temperature.	T_J	+150	°C
Operating Ambient Temperature.	T_A	-40 to +85	°C
Storage Temperature Range.	T_{STG}	-55 to +150	°C
KA5H0380R, KA5M0380R, KA5L0380R			
Drain-Gate Voltage (R_{GS}=1MΩ)	V_{DGR}	800	V
Gate-Source (GND) Voltage	V_{GS}	±30	V
Drain Current Pulsed (1)	I_{DM}	12.0	A_{DC}
Continuous Drain Current (T_C=25°C)	I_D	3.0	A_{DC}
Continuous Drain Current (T_C=100°C)	I_D	2.1	A_{DC}
Single Pulsed Avalanche Energy (2)	E_{AS}	95	mJ
Maximum Supply Voltage	$V_{CC,MAX}$	30	V
Analog Input Voltage Range	V_{FB}	-0.3 to V_{SD}	V
Total Power Dissipation	P_D	75	W
	Derating	0.6	W/°C
Operating Junction Temperature.	T_J	+150	°C
Operating Ambient Temperature.	T_A	-40 to +85	°C
Storage Temperature Range.	T_{STG}	-55 to +150	°C

Note:

1. Repetitive rating: Pulse width limited by maximum junction temperature
2. L = 51mH, starting Tj = 25°C
3. L = 13μH, starting Tj = 25°C

Electrical Characteristics (SenseFET Part)

(Ta = 25°C unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
KA5H0365R, KA5M0365R, KA5L0365R						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=50μA	650	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=Max. Rating, V_{GS}=0V	-	-	50	μA
		V_{DS}=0.8Max. Rating, V_{GS}=0V, T_C=125°C	-	-	200	μA
Static Drain-Source on Resistance (Note)	$R_{DS(ON)}$	V_{GS}=10V, I_D=0.5A	-	3.6	4.5	Ω
Forward Transconductance (Note)	gfs	V_{DS}=50V, I_D=0.5A	2.0	-	-	S
Input Capacitance	Ciss	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	720	-	pF
Output Capacitance	Coss		-	40	-	
Reverse Transfer Capacitance	Crss		-	40	-	
Turn On Delay Time	td(on)	V_{DD}=0.5BV_{DSS}, I_D=1.0A (MOSFET switching time is essentially independent of operating temperature)	-	150	-	nS
Rise Time	tr		-	100	-	
Turn Off Delay Time	td(off)		-	150	-	
Fall Time	tf		-	42	-	
Total Gate Charge (Gate-Source+Gate-Drain)	Qg	V_{GS}=10V, I_D=1.0A, V_{DS}=0.5BV_{DSS} (MOSFET switching time is essentially independent of operating temperature)	-	-	34	nC
Gate-Source Charge	Qgs		-	7.3	-	
Gate-Drain (Miller) Charge	Qgd		-	13.3	-	
KA5H0380R, KA5M0380R, KA5L0380R						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=50μA	800	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=Max. Rating, V_{GS}=0V	-	-	250	μA
		V_{DS}=0.8Max. Rating, V_{GS}=0V, T_C=125°C	-	-	1000	μA
Static Drain-Source on Resistance (Note)	$R_{DS(ON)}$	V_{GS}=10V, I_D=0.5A	-	4.0	5.0	Ω
Forward Transconductance (Note)	gfs	V_{DS}=50V, I_D=0.5A	1.5	2.5	-	S
Input Capacitance	Ciss	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	779	-	pF
Output Capacitance	Coss		-	75.6	-	
Reverse Transfer Capacitance	Crss		-	24.9	-	
Turn On Delay Time	td(on)	V_{DD}=0.5BV_{DSS}, I_D=1.0A (MOSFET switching time is essentially independent of operating temperature)	-	40	-	nS
Rise Time	tr		-	95	-	
Turn Off Delay Time	td(off)		-	150	-	
Fall Time	tf		-	60	-	
Total Gate Charge (Gate-Source+Gate-Drain)	Qg	V_{GS}=10V, I_D=1.0A, V_{DS}=0.5BV_{DSS} (MOSFET switching time is essentially independent of operating temperature)	-	-	34	nC
Gate-Source Charge	Qgs		-	7.2	-	
Gate-Drain (Miller) Charge	Qgd		-	12.1	-	

Note:

1. Pulse test: Pulse width ≤ 300μS, duty ≤ 2%
2. $S = \frac{1}{R}$

Electrical Characteristics (Control Part) (Continued)

(Ta = 25°C unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit
UVLO SECTION						
Start Threshold Voltage	V_{START}	V_{FB}=GND	14	15	16	V
Stop Threshold Voltage	V_{STOP}	V_{FB}=GND	8.4	9	9.6	V
OSCILLATOR SECTION						
Initial Accuracy	F_{OSC}	**KA5H0365R** **KA5H0380R**	90	100	110	kHz
Initial Accuracy	F_{OSC}	**KA5M0365R** **KA5M0380R**	61	67	73	kHz
Initial Accuracy	F_{OSC}	**KA5L0365R** **KA5L0380R**	45	50	55	kHz
Frequency Change With Temperature (2)	-	-25°C≤Ta≤+85°C	-	±5	±10	%
Maximum Duty Cycle	Dmax	**KA5H0365R** **KA5H0380R**	62	67	72	%
Maximum Duty Cycle	Dmax	**KA5M0365R** **KA5M0380R** **KA5L0365R** **KA5L0380R**	72	77	82	%
FEEDBACK SECTION						
Feedback Source Current	I_{FB}	Ta=25°C, 0V≤Vfb≤3V	0.7	0.9	1.1	mA
Shutdown Feedback Voltage	V_{SD}	Vfb≥6.5V	6.9	7.5	8.1	V
Shutdown Delay Current	Idelay	Ta=25°C, 5V≤Vfb≤V_{SD}	4	5	6	µA
REFERENCE SECTION						
Output Voltage (1)	Vref	Ta=25°C	4.80	5.00	5.20	V
Temperature Stability (1)(2)	Vref/ΔT	-25°C≤Ta≤+85°C	-	0.3	0.6	mV/°C
CURRENT LIMIT(SELF-PROTECTION)SECTION						
Peak Current Limit	I_{OVER}	Max. inductor current	1.89	2.15	2.41	A
PROTECTION SECTION						
Over Voltage Protection	V_{OVP}	V_{CC}≥24V	25	27	29	V
Thermal Shutdown Temperature (Tj) (1)	T_{SD}	-	140	160	-	°C
TOTAL STANDBY CURRENT SECTION						
Start-up Current	I_{START}	V_{CC}=14V	-	100	170	µA
Operating Supply Current (Control Part Only)	I_{OP}	V_{CC}≤28	-	7	12	mA

Note:
1. These parameters, although guaranteed, are not 100% tested in production
2. These parameters, although guaranteed, are tested in EDS(water test) process

Typical Performance Characteristics(SenseFET part)

(KA5H0365R, KA5M0365R, KA5L0365R)

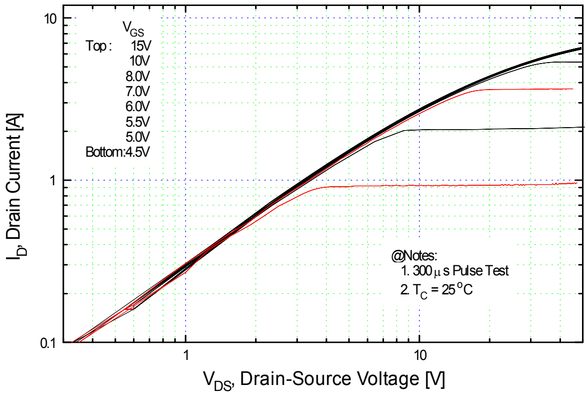


Figure 1. Output Characteristics

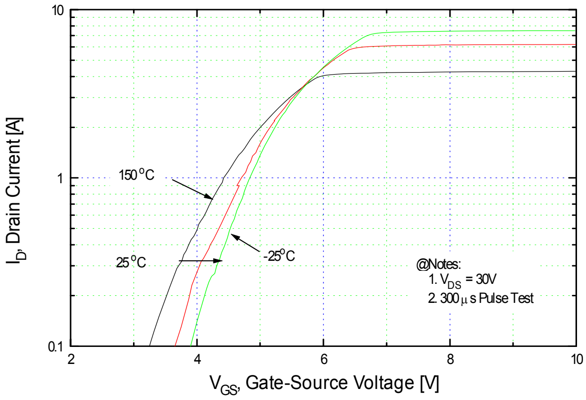


Figure 2. Transfer Characteristics

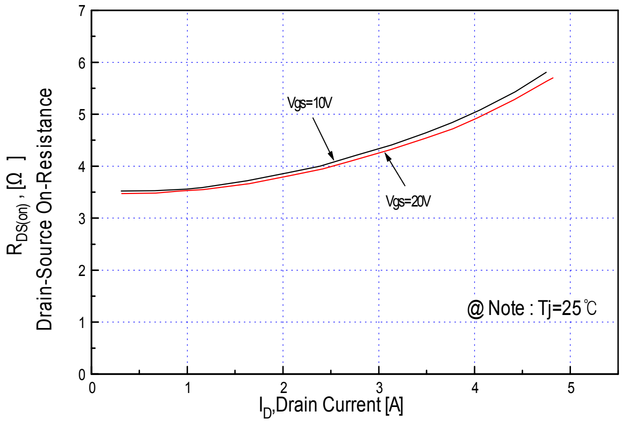


Figure 3. On-Resistance vs. Drain Current

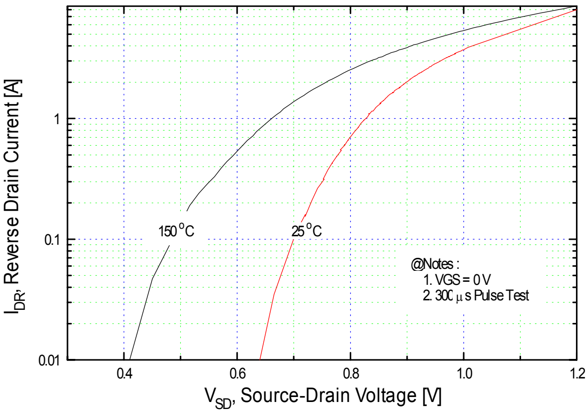


Figure 4. Source-Drain Diode Forward Voltage

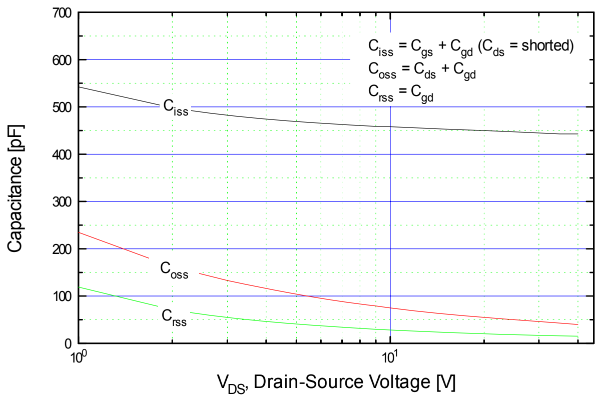


Figure 5. Capacitance vs. Drain-Source Voltage

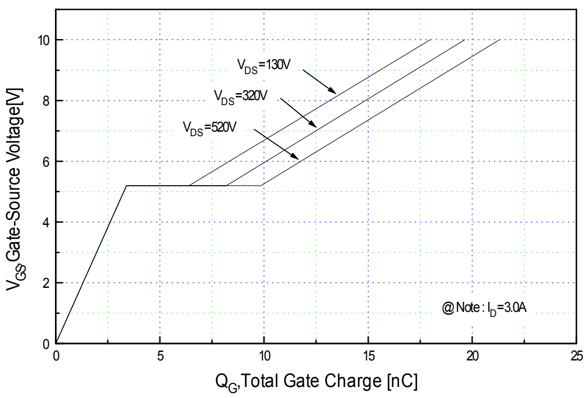


Figure 6. Gate Charge vs. Gate-Source Voltage

Typical Performance Characteristics (Continued)

(KA5H0365R, KA5M0365R, KA5L0365R)

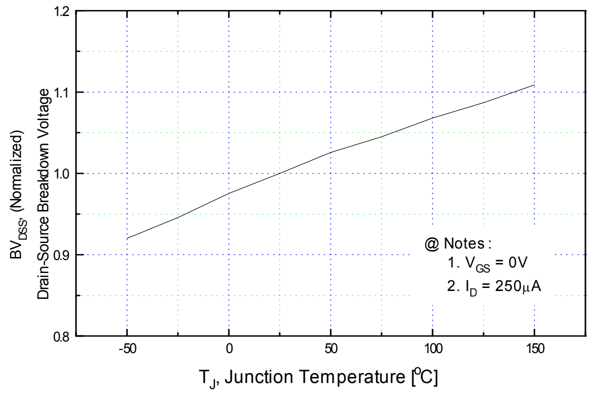


Figure 7. Breakdown Voltage vs. Temperature

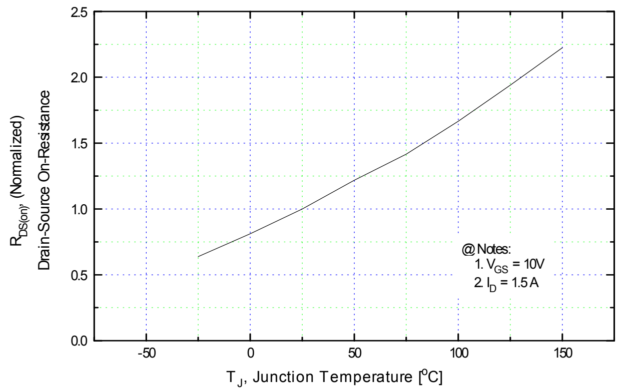


Figure 8. On-Resistance vs. Temperature

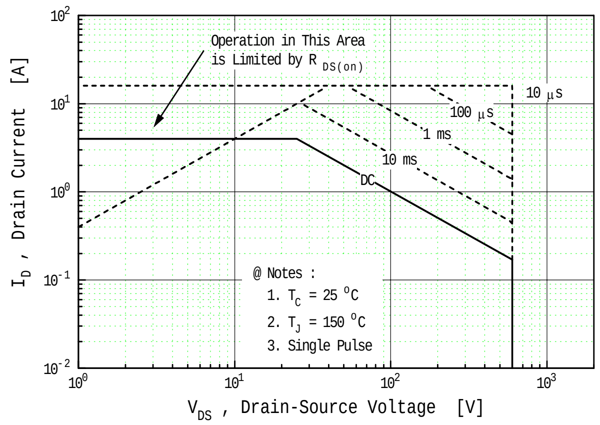


Figure 9. Max. Safe Operating Area

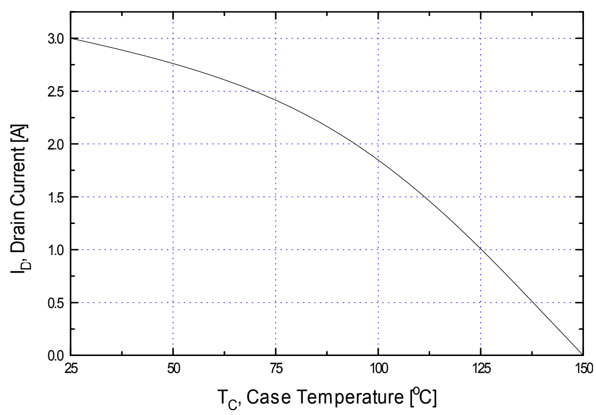


Figure 10. Max. Drain Current vs. Case Temperature

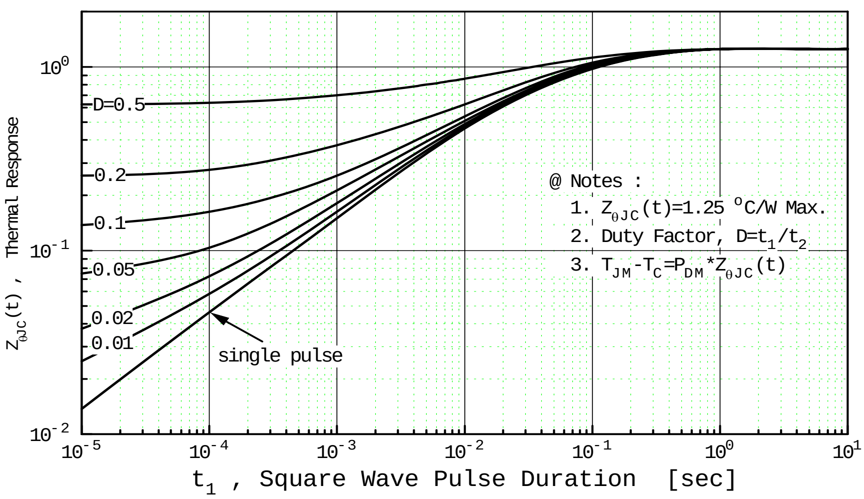


Figure 11. Thermal Response

Typical Performance Characteristics (Continued)

(KA5H0380R, KA5M0380R, KA5L0380R)

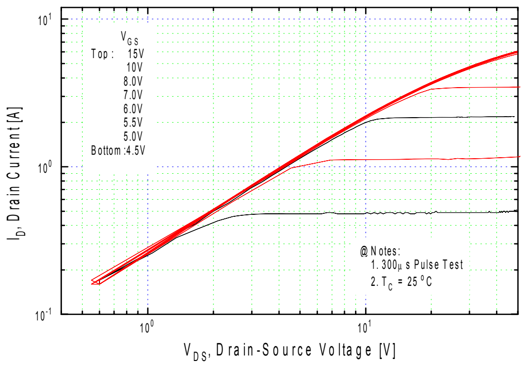


Figure 1. Output Characteristics

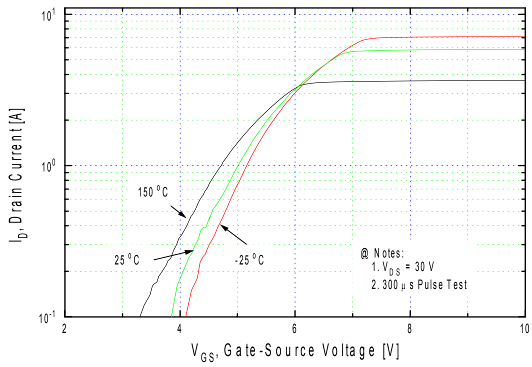


Figure 2. Thansfer Characteristics

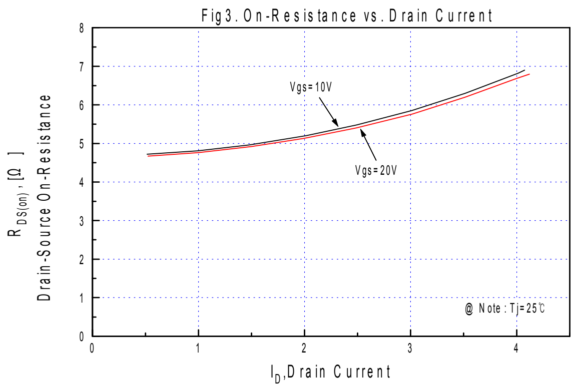


Figure 3. On-Resistance vs. Drain Current

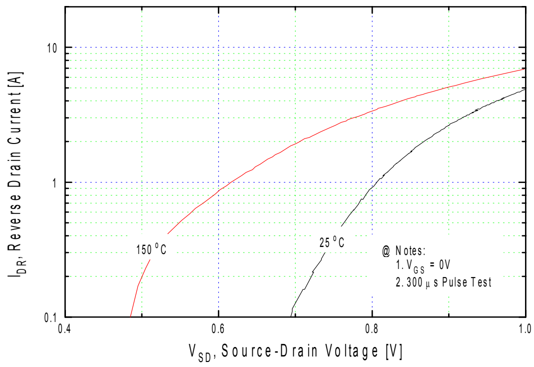


Figure 4. Source-Drain Diode Forward Voltage

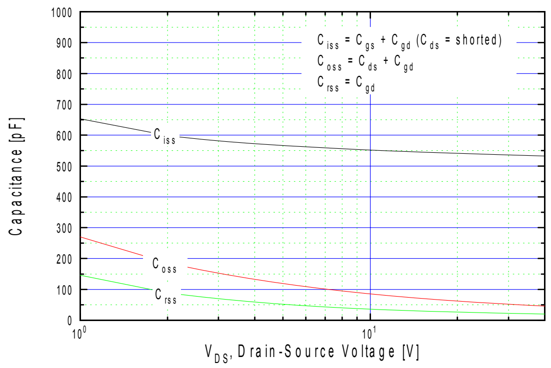


Figure 5. Capacitance vs. Drain-Source Voltage

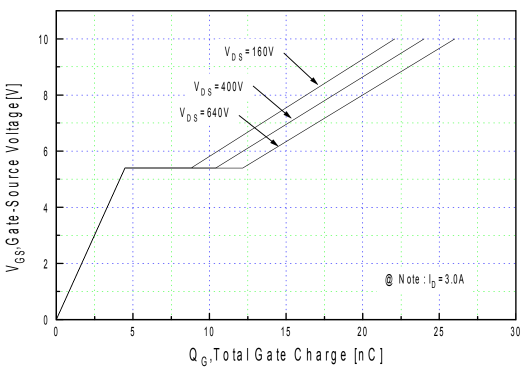


Figure 6. Gate Charge vs. Gate-Source Voltage

Typical Performance Characteristics (Continued)

(KA5H0380R, KA5M0380R, KA5L0380R)

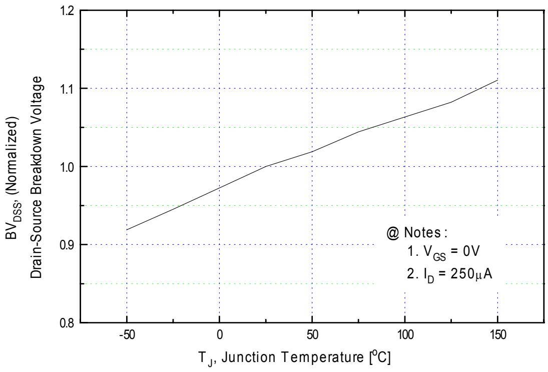


Figure 7. Breakdown Voltage vs. Temperature

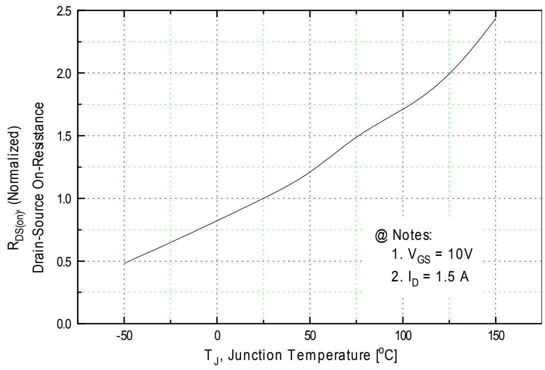


Figure 8. On-Resistance vs. Temperature

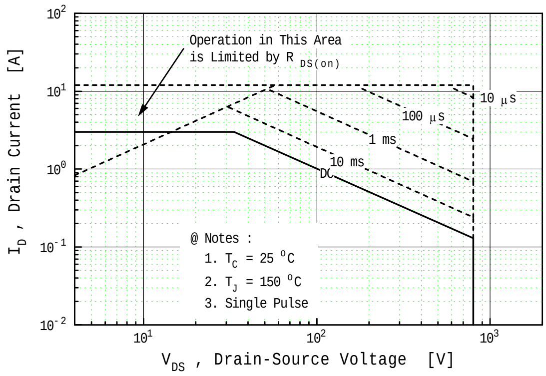


Figure 9. Max. Safe Operating Area

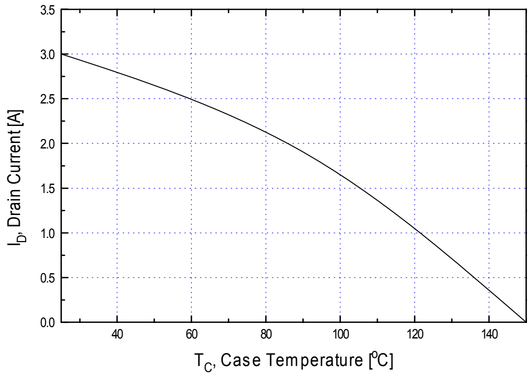


Figure 10. Max. Drain Current vs. Case Temperature

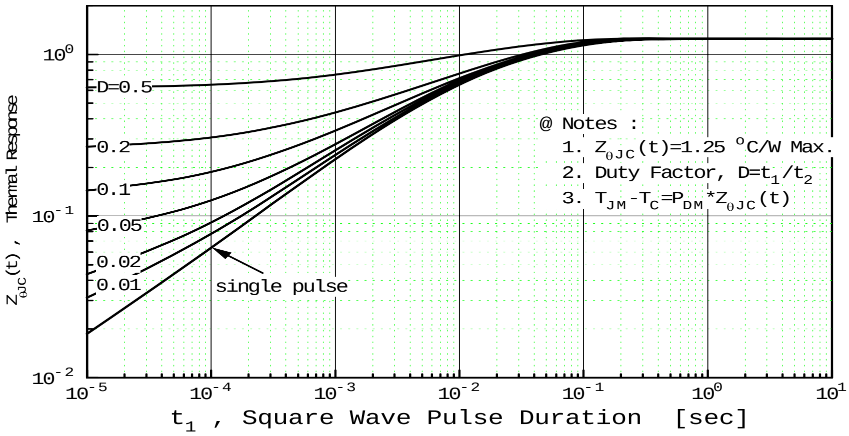


Figure 11. Thermal Response

Typical Performance Characteristics (Control Part) (Continued)

(These characteristic graphs are normalized at Ta = 25°C)

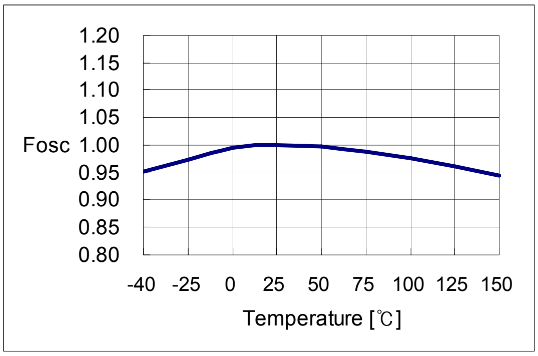


Figure 1. Operating Frequency

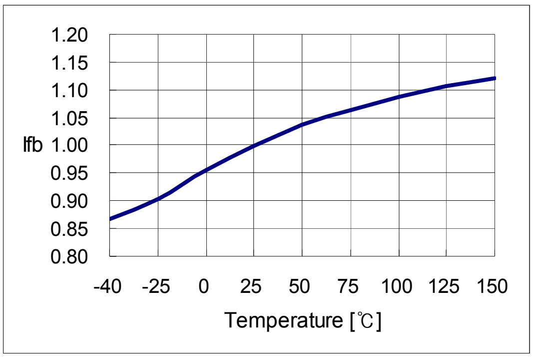


Figure 2. Feedback Source Current

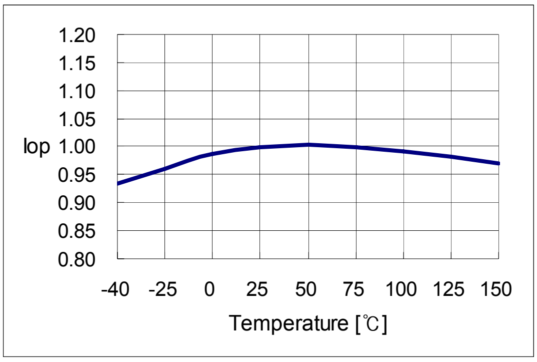


Figure 3. Operating Supply Current

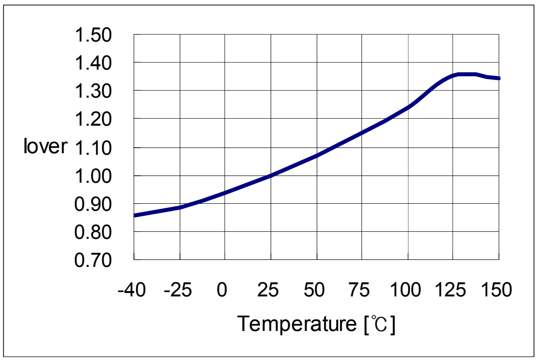


Figure 4. Peak Current Limit

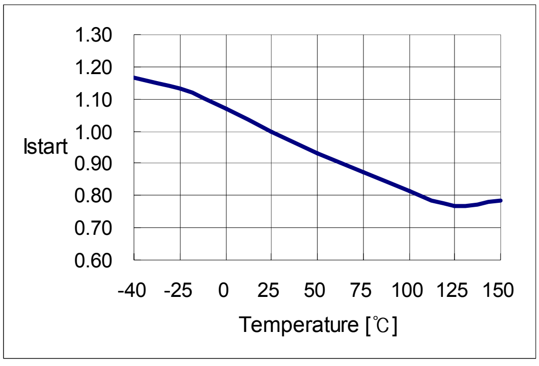


Figure 5. Start up Current

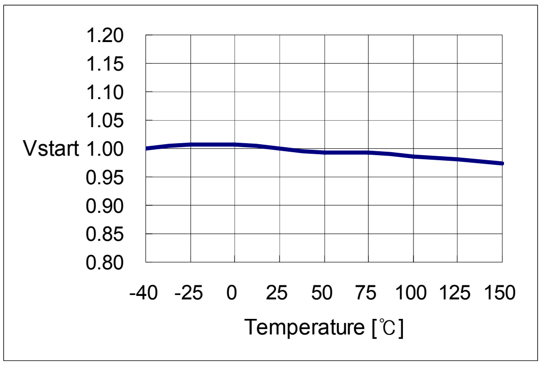


Figure 6. Start Threshold Voltage

Typical Performance Characteristics (Continued)

(These characteristic graphs are normalized at Ta = 25°C)

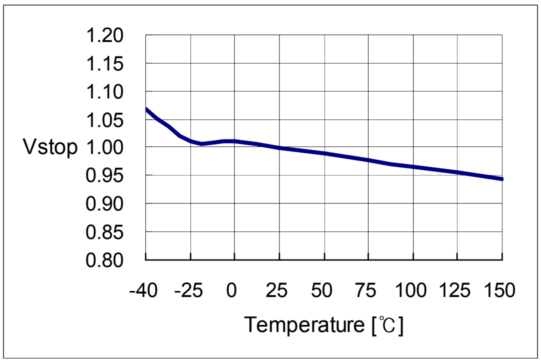


Figure 7. Stop Threshold Voltage

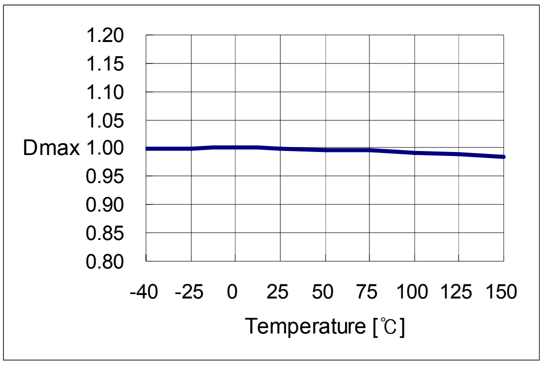


Figure 8. Maximum Duty Cycle

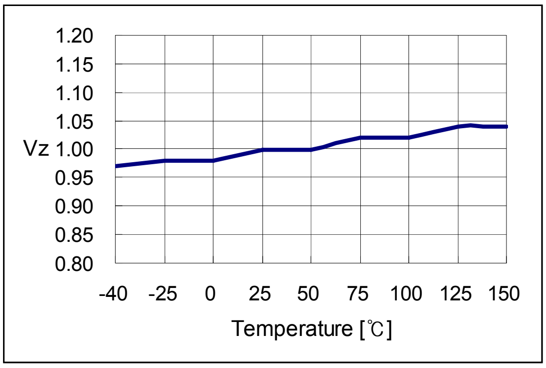


Figure 9. VCC Zener Voltage

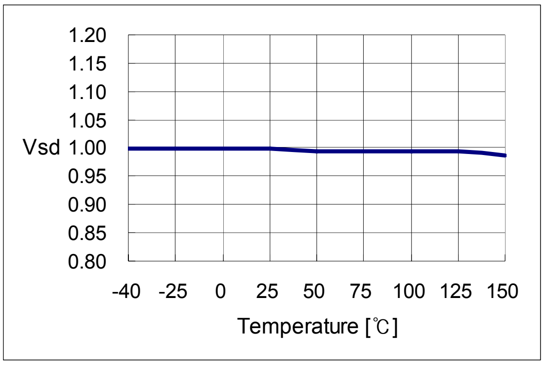


Figure 10. Shutdown Feedback Voltage

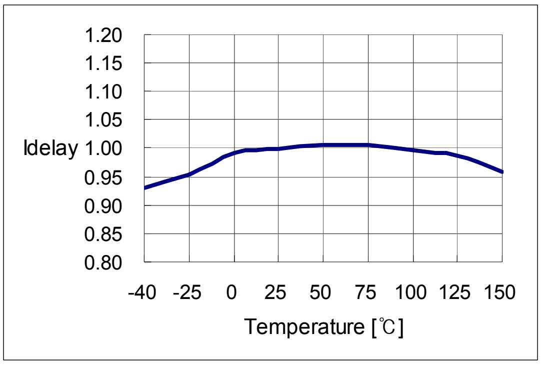


Figure 11. Shutdown Delay Current

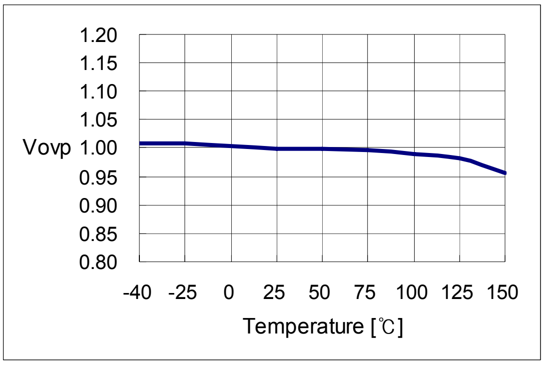


Figure 12. Over Voltage Protection

Typical Performance Characteristics (Continued)

(These characteristic graphs are normalized at Ta = 25°C)

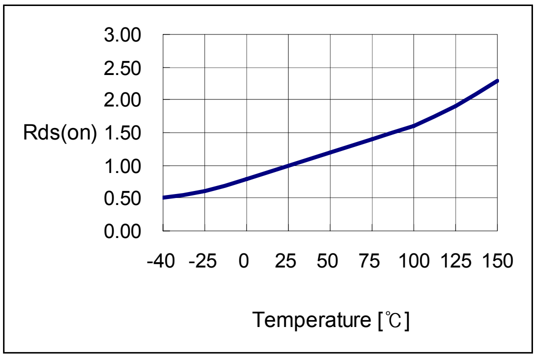
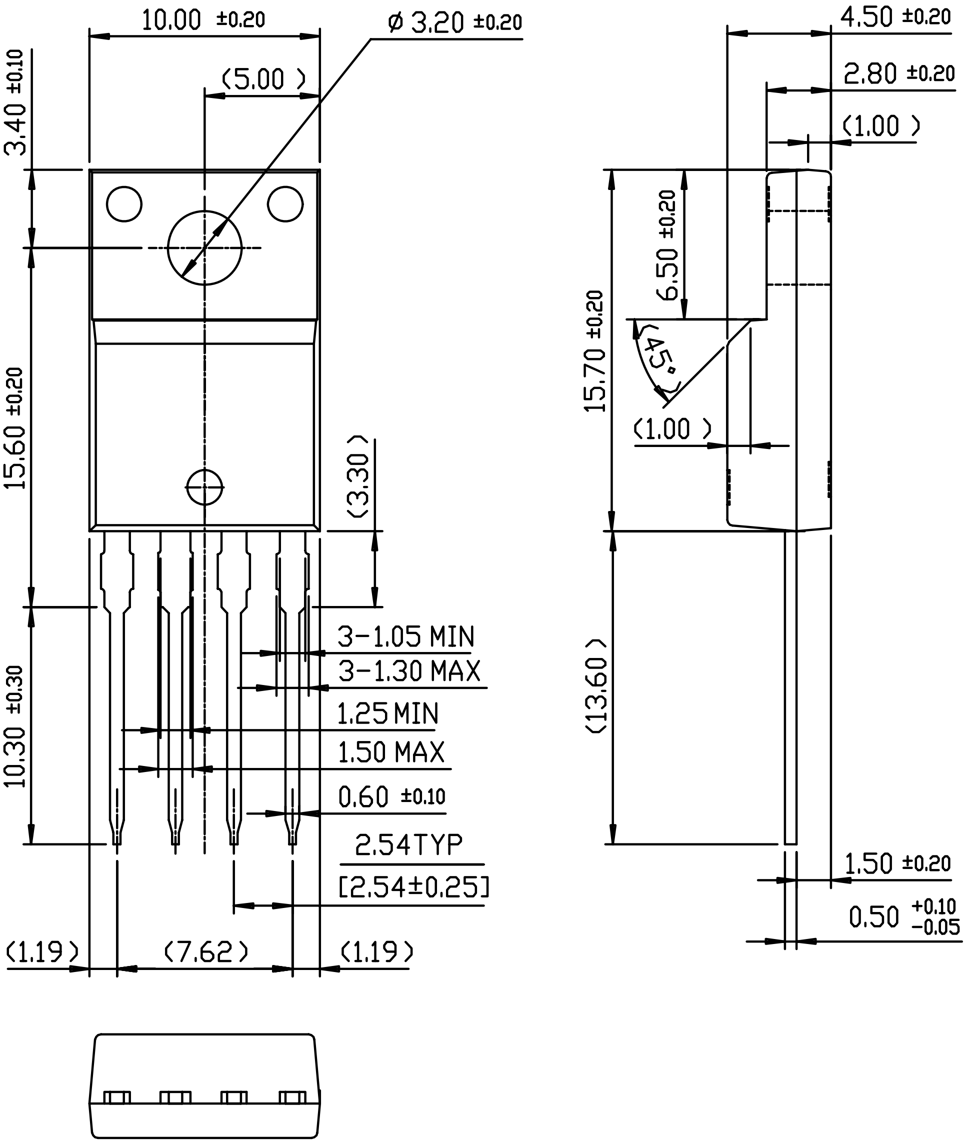


Figure13. Static Drain-Source on Resistance

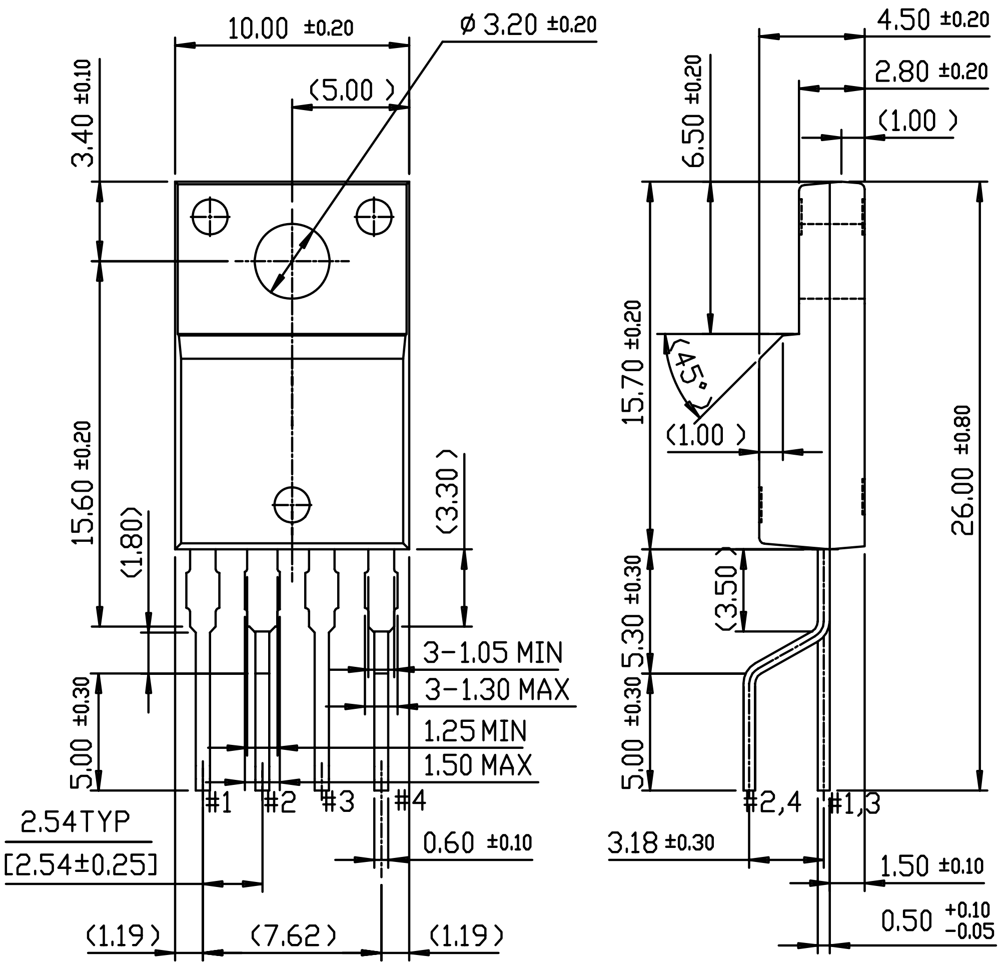
Package Dimensions

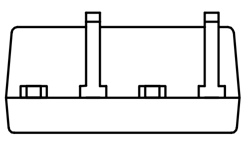
TO-220F-4L



Package Dimensions (Continued)

TO-220F-4L(Forming)





Ordering Information

Product Number	Package	Marking Code	BV_{DSS}	F_{OSC}	$R_{DS(on)}$
KA5H0365RTU	TO-220F-4L	5H0365R	650V	100kHz	3.6Ω
KA5H0365RYDTU	TO-220F-4L(Forming)				
KA5M0365RTU	TO-220F-4L	5M0365R	650V	67kHz	3.6Ω
KA5M0365RYDTU	TO-220F-4L(Forming)				
KA5L0365RTU	TO-220F-4L	5L0365R	650V	50kHz	3.6Ω
KA5L0365RYDTU	TO-220F-4L(Forming)				

Product Number	Package	Marking Code	BV_{DSS}	F_{OSC}	$R_{DS(on)}$
KA5H0380RTU	TO-220F-4L	5H0380R	800V	100kHz	4.6Ω
KA5H0380RYDTU	TO-220F-4L(Forming)				
KA5M0380RTU	TO-220F-4L	5M0380R	800V	67kHz	4.6Ω
KA5M0380RYDTU	TO-220F-4L(Forming)				
KA5L0380RTU	TO-220F-4L	5L0380R	800V	50kHz	4.6Ω
KA5L0380RYDTU	TO-220F-4L(Forming)				

TU :Non Forming Type
YDTU : Forming type

FAIRCHILD SEMICONDUCTOR®

TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

2Cool™
AccuPower™
Auto-SPM™
AX-CAP™*
BitSiC®
Build it Now™
CorePLUS™
CorePOWER™
CROSSVOLT™
CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficientMax™
ESBC™
®
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FlashWriter®*
FPS™
F-PFS™
FRFET®
Global Power Resource℠
Green FPS™
Green FPS™ e-Series™
G*max*™
GTO™
IntelliMAX™
ISOPLANAR™
Making Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
Motion-SPM™
mWSaver™
OptoHiT™
OPTOLOGIC®
OPTOPLANAR®
®
PDP SPM™
Power-SPM™
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
™
Saving our world, 1mW/W/kW at a time™
SignalWise™
SmartMax™
SMART START™
SPM®
STEALTH™
SuperFET®
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS®
SyncFET™
Sync-Lock™
SYSTEM GENERAL®*
The Power Franchise®
the power franchise
TinyBoost™
TinyBuck™
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TranSiC®
TriFault Detect™
TRUECURRENT®*
μSerDes™
μSerDes™
UHC®
Ultra FRFET™
UniFET™
VCX™
VisualMax™
VoltagePlus™
XS™

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I57